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DISPENSER FOR AEROSOLS AND HIGHLY VOLATILE FUMIGANTS

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The development of the liquefied gas method of producing insecticidal aerosols [1] has introduced a new technique to the entomological testing laboratory. It is not possible to handle these highly volatile solutions in the ordinary way, and some method must be devised to measure and disperse small quantities of liquid under pressure. The following is a description of a combination container and measuring device which, without waste of materials, can be used to handle aerosols, highly volatile fumigants, or less volatile liquids propelled by some liquefied gas.

Description of Apparatus

The dispenser can best be described by referring to the lettered parts in the drawing (fig. 1). The tank (A) is made of sheet iron approximately 0.05 inch in thickness, which is sufficient to withstand 1,000 lbs. per sq. in. pressure. A tank sold commercially as an aerosol container was found suitable. It was 2-1/2 inches in diameter and 7 inches high. It is provided with a screw plug (B) and lead washer (C) in the upper end and a low-melting safety plug (D) in the lower end. The valve (E) is attached to the lower end of the tank (A) by soldering or brazing. It is a standard 1/2-inch-pipe angle valve with a special wrench (P). The space around the stem of this type of valve is so large that small quantities of liquid cannot be measured because they do not rise into the glass cylinder (I). This space was greatly reduced by filling it with hot lead and drilling one small hole at (G). The valve stem had an enlargement which was removed before the lead was poured. Part of the valve was ground away so that it would fit inside the frame (H), and the top of the lead at (G) was smoothed to form a good seal with the leather washer (F). The frame (H) is made from a piece of 1/2-inch brass pipe 7 inches long. Windows 1/2 inch wide beginning very close to the bottom are cut to within 1 inch of the top on each side. The top is threaded inside with 3/8-inch pipe threads to accommodate the Y-valve (J) with the nut (K) to hold the valve rigid.

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[1] Goodhue, L. D. Insecticidal Aerosol Production. Indus. and Engin. Chem., Indus. Ed. 34 (12): 1456-1459. Dec. 1942.

The frame (*H*) is soldered to the valve (*E*) and up the side of the tank (*A*). The heavy glass measuring tube (*I*) with smoothly ground ends to seat in the washers (*F*) is of 1/2 inch outside diameter and is graduated to 1/2 ml. It is held in place between the leather washers (*F*, *F*) by screwing down the valve (*J*).

The valve (*J*) is a standard Y-valve for use on small drums containing liquefied gas refrigerants. It has a 3/8-inch male pipe connection for the drum and a 1/8-inch female pipe thread at the outlet. This valve is also filled with a small amount of solder or lead so that the upper washer (*F*) has a smooth bearing surface. This valve does not come equipped with the hand wheel (*L*), so one was added later.

The needle (*M*) is for soil treatment; it consists of a nipple with a hexagon nut, to which has been soldered an 8-inch piece of heavy-walled 1/4-inch metal tubing. The tip is closed and pointed. Holes 1/64 inch in diameter are drilled from opposite sides at (*N*) near the tip, and some of the metal is filed away to recess the openings and prevent clogging by soil. Any other desired connection can be made in place of the needle (*N*). For use with aerosols a 0.017-inch-diameter capillary (*O*) 4 inches long, soldered in a nipple, is used as a nozzle. Permanent connections can also be made to a small fumigation chamber at this point.

To fill this dispenser with methyl bromide, it is only necessary to pour the chilled liquid in through the opening which is closed by the plug (*B*). When carbon disulfide and dichlorodifluoromethane are used, the carbon disulfide is poured in, and the liquefied gas is added through the measuring device by connecting the valve (*J*) to the source of supply. Aerosol solutions are also loaded through the valve (*J*) by the same technique used to transfer any liquefied gas from one container to another.

To measure out and release a desired quantity of aerosol solution or fumigant, close the upper valve (*J*) and slowly open the lower valve (*E*), which allows liquid to flow, without boiling, into the glass tube (*I*) up to the desired mark. The lower valve is then closed, the whole apparatus is inverted, and the charge flows out as the upper valve (*J*) is opened.

Uses for the Apparatus

The apparatus is obviously well adapted to dispense small quantities of an aerosol solution. Where many different solutions are being tested, a complete apparatus should be available for storing and dispensing each solution.

Where a number of tests are to be made with a volatile fumigant such as methyl bromide, the dispenser is also well suited. The fumigant can be measured and dispensed quantitatively without loss and without the trouble of cooling the liquid below its boiling point. The fumigant can be released into a fumigation chamber by inserting the soil-injecting needle through a hole in a stopper in the side of the chamber.

Fumigants such as carbon disulfide that do not have pressure enough for self propulsion can be mixed in suitable proportions with some liquefied gas. One example is three parts of carbon disulfide and one part of dichlorodifluoromethane by weight. The mixture containing ethylene dichloride and methyl chloride is another example.

Practical Tests

The device has proved suitable for measuring out methyl bromide for small-chamber fumigations. With the needle for soil fumigation in place, practical tests on the treatment of ant hills with methyl bromide also have been made. In 75 tests against several species of ants (including _Formica fusca_ var. _subserica_ Say, _F. pallidefulva schaufussi_ var. _incerta_ Emery, _F. pallidefulva_ Latr. var., _Lasius niger_ var. _neoniger_ Emery, and _Tetramorium caespitum_ (L) as identified by M. R. Smith), single treatments with 2 c.c. of methyl bromide injected about 4 inches below the surface have killed out colonies in hills up to 14 inches in diameter. The material is injected and the openings to the colony are closed by stepping on the loose surface soil. Treatments have been made in lawns, vegetable gardens, flower borders, and among plants growing in flagstone walks, without evidence of plant injury on bluegrass, red top, Dutch clover, zinnias, marigold, pachysandra, mugho pine, Torenia, and strawberry. However, severe injury and even death has occurred to endive plants growing in pots or in the field, to carrots in the field, and to bluegrass in lawns containing no ant colonies. The bluegrass was killed out in patches about 4 inches in diameter. Apparently injury did not occur on plants growing in the vicinity of treated ant hills because the subterranean galleries permitted greater dispersion of the fumes than occurred in undisturbed soil.

Preliminary tests on ants with the carbon disulfide-dichlorodifluoromethane mixture up to dosages of 3 c.c. of CS_2 per square foot gave less reliable results than those obtained with methyl bromide.

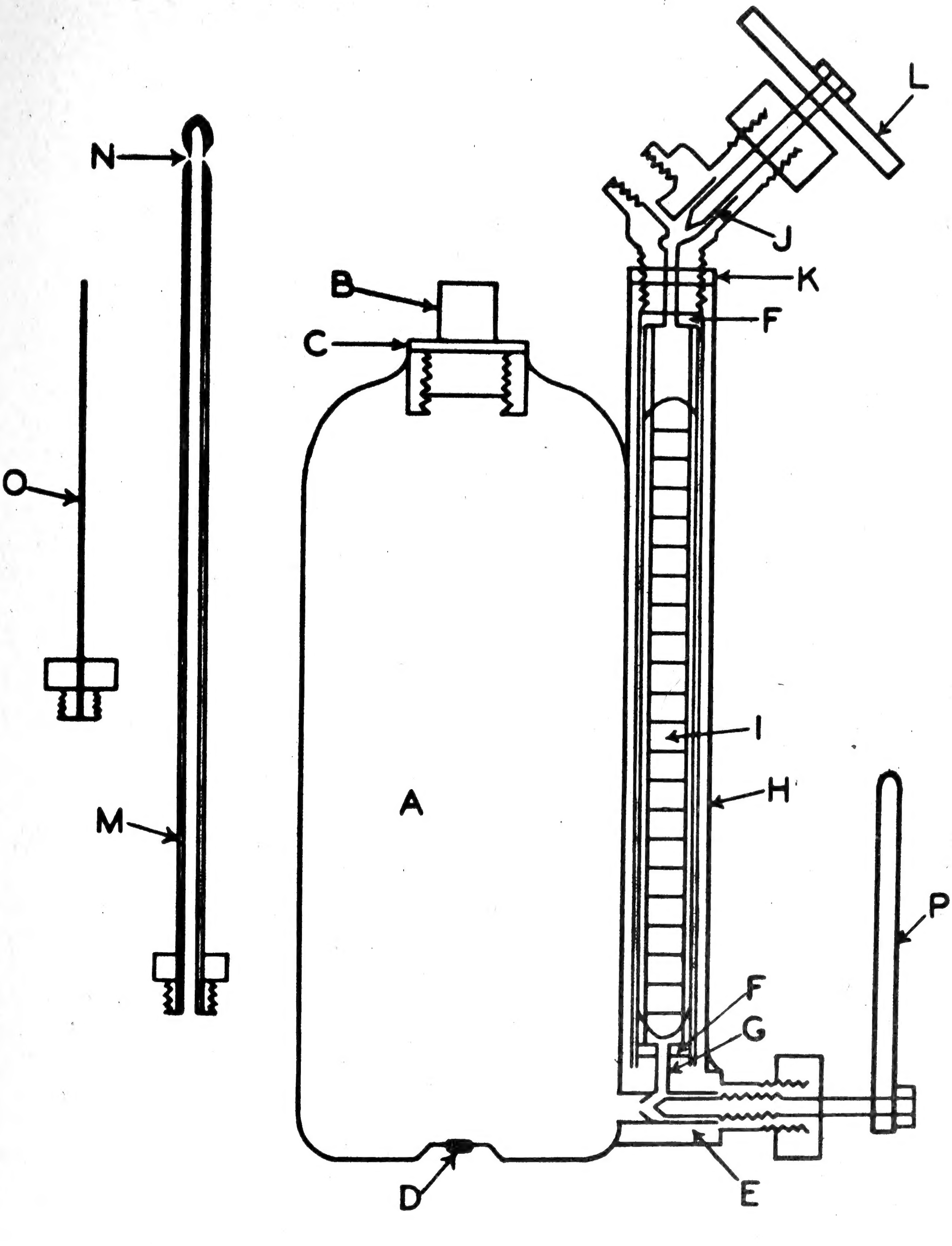

FIGURE I. CROSS SECTION OF DISPENSER SHOWING DETAILS OF CONSTRUCTION